

Inversion

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Inversion has been much in the news for some months now. Indeed, inversion has made the big time, with William Safire devoting a column in the Sunday *New York Times* (April 23, 2006) to IYC—inverted yield curve. By inversion, of course, I’m referring to a situation in which short-term interest rates are higher than long-term interest rates.

When I agreed to speak on this topic last fall, market concern over IYC was running high. The FOMC had been providing guidance that it would probably continue to raise the target federal funds rate; given the level of the 10-year Treasury yield in the $4\frac{1}{4}$ to $4\frac{1}{2}$ percent range, market observers expected that the funds rate would soon be above the 10-year rate. Recession concerns were widely discussed, because in the past IYC has often been associated with recession. Moreover, many found it odd that until last month the monthly average 10-year bond rate was actually lower than it had been in June 2004, when the FOMC began to raise the fed funds rate target. It seemed a puzzle that the 10-year rate was actually the same in March 2006 as it had been in June 2004, even though the FOMC had raised the target fed funds rate from 1 percent to $4\frac{3}{4}$ percent. Now that the 10-year rate has risen by another 50 to 75 basis points, to about 5.15 percent, apparently everyone feels a lot better!

For simplicity, using monthly average data, except where indicated otherwise, I’ll concentrate on the difference between the 10-year constant-maturity Treasury yield and the federal funds rate. Some analysts this past winter called attention to an inversion between the 1- or 2-year rate

and the 10-year rate, but looking for some particular part of the yield curve where a shorter rate is above a longer rate is scratching for a story. Surely, no important issue can depend on an inversion somewhere along the yield curve of a few basis points.

Before proceeding, I want to emphasize that the views I express here are mine and do not necessarily reflect official positions of the Federal Reserve System. I thank my colleagues at the Federal Reserve Bank of St. Louis—especially Michael Dueker—for their assistance and comments, but I retain full responsibility for errors.

TERM-STRUCTURE THEORY

An important problem with much IYC commentary is that it involves a search for patterns in the data without an effort to understand the economics that might lie behind the patterns. Understanding why observations follow a particular pattern is essential to judging whether a pattern is likely to persist or apply to today’s situation.

Economists have been studying the term structure of interest rates for a long time. The first proposition is that a long interest rate reflects investor expectations of the average short rate over the horizon of the long rate. Thus, today’s 1-year rate reflects expectations of the next 52 1-week rates; today’s 10-year rate reflects expectations of the next 10 1-year rates.

I deliberately used the phrase “reflects expectations” because there is ample evidence that a long rate is not always equal to the appro-

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priately weighted average of the short rates over the horizon of the long rate. Most of the time, long rates are somewhat above short rates. Over the past 50 years, for example, the 10-year Treasury rate has averaged about 90 basis points above the federal funds rate. The difference between the long rate and average expected short rate over the horizon of the long security is called the “term premium.”

On average, the term premium is positive, but theory does not predict any particular relationship. The term premium is thought to arise from investor attitudes toward risk. Capital values fluctuate more the longer a bond’s maturity, and investors averse to capital risk therefore prefer shorter maturities. On the other hand, interest income fluctuates more for a series of investments in short-term bonds than for a long-term bond; investors averse to income instability therefore prefer longer-term bonds.

The balance of investors with different and changing attitudes toward risk changes over time, and other conditions may also change. Thus, there is no reason to expect that term premiums will be constant, and they aren’t. Given that investor expectations about future short rates are not directly observable, and their preferences that create term premiums are not directly observable either, there is no absolutely reliable way to disentangle changing interest rate expectations from changing term premiums.

SOME HISTORY

Many of the inversions of the yield curve starting in the 1960s occurred under the old deposit interest rate ceilings established under Regulation Q. The ceiling on the deposit rate led to “disintermediation” from the banking system when monetary policy tightened and increased the responsiveness of the quantity of money inside the banking system to Federal Reserve policy actions. However, there was no inversion associ-

ated with the recessions of 1957-58 and 1960-61. Before the mid-1960s, the Fed adjusted Regulation Q interest ceilings in a fashion timely enough to prevent significant disintermediation.

In an environment of slow adjustment of Reg Q ceilings, when the Fed stepped on the monetary brakes, bank credit became tight and the real short-term interest rate quickly rose well above its equilibrium level. Because the market anticipated that the monetary brakes would be loosened within a relatively short time frame, long-term interest rates rose by a much smaller amount, and the yield curve inverted temporarily. It was during this era that yield-curve inversions came to carry negative business-cycle connotations. All too often, the clampdown on credit was severe enough to be associated with a recession but not steadfast enough to bring about lasting disinflation.

Fortunately, since the early 1980s, three things have changed for the better. First, lasting disinflation was achieved in the Volcker-Greenspan era. Second, financial deregulation did away with Regulation Q, and important financial innovations, such as hedging instruments, have lessened the economic fallout from shocks. Third, the economy itself has become more stable—a phenomenon known as the “Great Moderation.” Moreover, these positive developments reinforce each other because, as Chairman Bernanke has noted in Congressional testimony, a more stable environment provides monetary policymakers greater latitude to respond aggressively to shocks.¹ It was this latitude that permitted the Federal Reserve to maintain the federal funds rate at 1 percent from June 2003 to June 2004 while waiting patiently for the current expansion to establish firm legs.

IYC AS RECESSION PREDICTOR

One quip about the predictive power of yield curve inversions is that they have predicted six

¹ Testimony of Chairman Ben S. Bernanke, Semiannual Monetary Policy Report to the Congress before the Committee on Financial Services, U.S. House of Representatives, February 15, 2006.

of the last four recessions. In fact, starting in the mid-1960s, there have been nine notable inversions of the yield curve and six business recessions. The historical record of yield curve inversions, recessions, and false alarms reveals several regularities. Such an analysis also sheds light on today's relatively flat yield curve.

The basic proposition is that the yield curve reflects investor expectations of future interest rates. These expectations depend on anticipated Fed policy adjustments, which in turn reflect expected developments in the real economy and the rate of inflation. Consider a classic episode to illustrate the process. Inflation began to rise persistently in 1967 and, after the middle of the year, the Fed began to tighten policy. In response to tighter fiscal policy enacted in mid-1968, which many believed would cool the economy, the Fed eased policy a bit. However, the economy did not slow and inflation continued to worsen. The FOMC then raised the fed funds rate almost every month. The yield curve had inverted slightly in the spring of 1968, and the inversion deepened as the Fed tightened policy. In August 1969, the peak month for the funds rate, the inversion reached its maximum extent of 250 basis points. The business cycle peak was December. Not until March 1970 did the Fed ease policy enough to bring the funds rate down significantly.

The basic story, as I see it, was that the Fed was slow to ease policy in 1969 and 1970 because it was concerned about the inflation rate. The bond market could see that the economy was weakening and that rates would be coming down, which is why the inversion developed. But the Fed did not want to ease policy until inflation slowed, both because it wanted to maintain downward pressure on the inflation rate and because it was concerned that premature easing would raise inflation expectations. This same pattern played out in spades in the months around the November 1973 business cycle peak. Inflation was much higher and inflation expectations more entrenched. Using monthly average data, the peak fed funds rate was in July 1974 and the inversion that month was over 500 basis points. The economy weakened dramatically in the second half

of 1974, and the Fed eased policy. The inversion lasted through December.

The story around the cycle peak in March 2001 was a bit different. The Fed maintained a target for the funds rate of 6.5 percent starting in mid-May 2000. After May, the 10-year Treasury rate fell a bit and the yield curve inverted. The inversion reached a maximum of 116 basis points in December. Policy in 2000 was dominated by concern over the threat of inflation rather than actual inflation. The FOMC began to cut the funds rate target in January 2001, ahead of the cycle peak in March. The inversion ended in April as the Fed cut the funds rate target aggressively. While it is true that an inversion preceded the cycle peak, it is also true that the FOMC began to cut rates before the cycle peak and indeed cut aggressively because inflation was controlled.

Now that I've reviewed a few episodes, let's try to generalize a bit. Using weekly average data to tie down timing relationships accurately, the last date on which the yield curve is inverted by at least 100 basis points can be considered the date on which the inversion ebbs and starts to tail off. We'll call this date the "ebb date." One interesting pattern across yield curve inversions is that the long rate typically rises, although sometimes only slightly, in the three months prior to the start of the inversion and then falls in the three months prior to the ebb date. It is not obvious that the long rate would be falling as the inversion is declining, but this pattern held in many of the inversions that preceded or coincided with recessions—specifically the inversions that started in 1968, 1973, 1978, 1982, 1989, and 2000. These cases fit the scenario whereby monetary policy initially tightens enough to lift all interest rates, including long-term rates, but a weakening economy and market anticipations of Fed easing subsequently lead to declines in long-term rates. The inversion ebbs because the Fed sees the weakening economy and brings the funds rate down, and the funds rate declines more quickly than does the long rate.

It is also worth noting that in all six of these classic instances where an inversion of the yield curve preceded a recession, the real federal funds

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rate—measured as the difference between the federal funds rate and core PCE inflation—exceeded 4 percent and sometimes by a wide margin. These were episodes of substantial policy restraint, motivated by inflation or the threat of inflation.

There are three false alarm cases where no recession ensued—the inversions that began in 1966, 1995, and 1998. In none of these cases did the inversion reach 100 basis points using monthly average data. In the false alarm cases, the real federal funds rate was at or somewhat below 3 percent.

The anomaly among the inversions, in that it is neither one of the classic cases nor a false alarm, is the inversion that started in October 1980. The ebb date of this inversion, in September 1981, occurred in rather unusual circumstances. The economy had gone back into recession in July 1981 and the 10-year rate was near its post-war high of about 15½ percent at the height of the Fed's struggle to bring inflation down. Although by September 1981 the fed funds rate had come down from its peak earlier in the year, the policy outlook was extremely uncertain because the inflation outlook was so uncertain. As it turned out, the economy weakened rapidly as the recession took hold and both long and short rates declined after September 1981. The inversion disappeared as short rates declined more quickly than long rates, but then reappeared for a few months in 1982.

Analyzing the current situation in light of these patterns, using weekly average data, the spread between the 10-year Treasury and the federal funds rate never became negative this past winter, though it came close to zero in January and February. The real federal funds rate has remained below 3 percent in all of 2006. Thus, the recent relatively flat yield curve has much more in common with the cases where yield curve inversions were not followed by a recession.

One lesson from these episodes is that the yield curve must be combined with additional information in order for a reliable recession signal to emerge. In particular, the term spread should be considered jointly with the level of the real

short-term interest rate when gauging whether recession is likely.

As a recession predictor, yield-curve inversions do not outperform other simple rules of thumb, such as troughs in the unemployment rate. Even though the unemployment rate is widely known as a lagging economic indicator, a simple predictive rule is that a rise from a trough level in the unemployment rate by at least 0.3 percentage points lasting at least three months occurs prior to every cycle peak. For example, by August 2000, the unemployment rate had risen 0.3 percentage points above an April 2000 trough rate of 3.8 percent. The recession then began seven months later in March 2001. Nevertheless, the eight correct signals from the unemployment rate are accompanied by three false alarms—with the latest in February 1986. This ratio of hits to misses is similar to the ratio for yield curve inversions. Undoubtedly, we could find many other recession signals that would match the record of inverted yield curves. That all these supposed signals are of limited value is indicated by the fact that forecasters do not have a stellar record of forecasting recessions. If the signals were clear, forecasting would be easy. It is not.

I haven't attempted a citation count to determine when inversion aversion reached its peak intensity, but the discussion was certainly active from late last fall to early this year. Perhaps what triggered this discussion was that, while the FOMC was raising the target fed funds rate starting in June 2004, the 10-year rate traded most of the time in a range from 4 to 4.5 percent. Last fall, as the target funds continued to rise but the 10-year rate did not, it appeared only a matter of time until the inversion would occur. In fact, using monthly average data, we have not had an inversion through April 2006.

The key to understanding this situation is that increases in the target funds rate were well predicted in June 2004, when the increases began from the unusually low federal funds rate of 1 percent. In June 2004, the market correctly gauged that the Fed would raise the funds rate steadily and gradually for the next year and a half. Not

until the November 2005 FOMC meeting did the target funds rate exceed the rate that had been expected in June 2004. With the funds rate rising on the expected track, there was no reason for the 10-year bond rate to depart in any major way from its level in June 2004. The increase in the bond yield since November 2005 is consistent with the idea that the funds rate has now increased somewhat more than the market anticipated earlier.

Why did rates behave so much the same as expected in June 2004? The most important reason is that the economy came in so close to what had been forecast. Going as far back as January 2004, the Blue Chip forecasters maintained very steady and accurate forecasts of 2005 GDP growth, which came in at 3.5 percent. The main surprise was in the inflation rate. In turn, that surprise was a consequence of energy prices, which have increased far beyond levels predicted in June 2004 but even today have not much affected core inflation. What has happened to raise the expected path for the target federal funds rate from expectations in place late last year, and therefore has also affected longer-term rates, is the persistence of energy price increases. In January 2005, the Blue Chip consensus for CPI inflation for 2006 was 2.3 percent. As of the May 2006 Blue Chip release, that consensus is now up to 3.1 percent; much of this increase took place after Hurricane Katrina.

Unless we experience significant departures from the expected course for the economy, the recent rise in the 10-year Treasury yield from about 4.6 percent in February to about 5.15 percent today has done much to diminish the likelihood of a substantial inversion in the yield curve in the near future.

RECENT BEHAVIOR OF LONG-TERM RATES AND THE TERM PREMIUM

I've emphasized the importance of interest rate expectations for shaping the yield curve and believe that the rate expectations story explains

most of what we've observed. But there are no doubt other forces at work. It appears that the term premium in long rates fell as the funds rate target increased. One likely reason that the term premium fell in the first year and a half of this tightening cycle is that the market understood the path that short-term interest rates would take in the tightening cycle that began in late June 2004. That predictability reduced the risk of holding longer-term bonds.

Market commentary has attributed much of the recent increase in long rates to a restoration of a more-normal term premium for holding long-term debt. But policymakers should not view the term premium as a single component of long-term interest rates. Instead, the term premium consists of compensation for the risk that real interest rates will turn out to be higher than expected in the future and separate compensation for the risk that inflation will turn out to be higher than currently expected. Naturally, if the term premium increases because of changes in bearing real interest rate risk, as a policymaker I am more comfortable with that than if the term premium increases because of market concerns about the risk of inflation. Yields on Treasury inflation-indexed securities, combined with factor models of the term structure of interest rates, suggest that the compensation for bearing real interest-risk dropped between June 2004 and late 2005, although it has rebounded somewhat since then. Because some of these factor models suggested that the term premium had dipped nearly to zero by late 2005, some rebound was likely.

Among the international factors cited as influences on U.S. interest rates in the past few years is the global saving glut. Unusually high saving might hold down the level of real interest rates, but there is no reason why there should be an effect on the shape of the term structure. In any event, it appears that real interest rates are returning to a more normal level in the United States. The 10-year indexed bond had a rate of about 1.6 percent in the fall of 2004; that rate is now up to about 2.4 percent.

FORWARD RATES

Although the yield curve is an imperfect recession predictor, the term structure of interest rates provides very useful glimpses of what short-term interest rates are likely to be in the future. A forward interest rate far enough into the future, say nine years ahead, provides information about the trend rate of inflation markets expect. Measures of expected inflation in the short run, say in the next two years or so, reflect energy price shocks, for example, that will not influence the long-run trend rate of inflation. Similarly, no one can forecast the state of the business cycle nine years into the future, so the implied far forward rate reflects neutral business cycle conditions. For this reason, a clear shift up or down of the implied far forward rate suggests that either the trend level of expected inflation has changed or the market's inference of the trend real rate of return has been altered. In principle, one could use data on stripped inflation-indexed bonds to infer the implied forward real rate, but trading in this market is somewhat thin. Nevertheless, the implied far forward real rate is not expected to undergo sudden changes. Hence we can interpret, as a good approximation, changes in the implied far forward nominal rate as a combination of changes in long-term inflation expectations and in the term premium.

Price data from stripped Treasury bond coupons show that the implied far forward one-year rate nine years in the future has fallen since the Fed initiated its tightening cycle in June 2004. In that time span the implied forward rate has fallen from about $6\frac{1}{8}$ percent to about $5\frac{1}{2}$ percent. Thus, the signal from the Treasury bond market is that the Fed's measured but steady pace of removing policy accommodation has been sufficient to keep long-term inflation expectations and risk premia well-contained.

CONCLUDING COMMENTS

I must say that I've been a bit puzzled by the inversion/recession talk that began last fall. As

already noted, the spread between the 10-year bond and the fed funds never became negative last fall and still isn't. Yet, inversions associated with recessions have been quite large. Using monthly average data, the 1969 inversion reached 250 basis points; the 1974 inversion exceeded 500 basis points; the 1980 and 1981 inversions exceeded 600 basis points. Milder inversions seem to have been associated with milder recessions. The 1989 inversion reached 125 basis points and the 2000 inversion reached 116 basis points. We never got close to any of these last fall. Finally, looking back at 1980-82 experience makes clear that simply counting presumed patterns in the data, without guidance from economic theory, is not a wise strategy. The early 1980s were so different from today's conditions in so many respects that the experience of twin recessions in a high inflation era has little bearing on understanding the term structure today.

The term structure of interest rates provides a window into investor interest rate expectations. It is always worthwhile for policymakers to consider those expectations but not wise to take them at face value without further analysis. Interest-rate expectations reflect investor understanding of how rates will evolve, which is why an inverted yield curve has often preceded business cycle peaks. But the market's rate expectations also depend importantly on the market's read of what the FOMC will do. If the market's expectation does not match the FOMC's own expectation, then policymakers need to do some soul searching. There are two possibilities: either the market may have a better understanding of where the FOMC is likely to take policy than the FOMC does, or the market may be misreading the FOMC's intentions.

Arguably, the market was ahead of the FOMC in 2000; the peak for the 10-year rate was 6.66 percent in January, and by December the rate was down to 5.24 percent. As evidence of the economy's weakening accumulated, the FOMC first cut the fed funds rate target in January 2001. Conversely, after the FOMC lowered the funds rate target to 1 percent in June 2003, the market seemed primed to expect that the Committee

would soon be raising the rate. To better align market expectations with its own, in its August 2003 meeting the FOMC introduced language in its statement indicating that “the Committee believes that policy accommodation can be maintained for a considerable period.”

At least as of today, the market’s concerns last fall that the yield curve would invert and signal a recession seem to have evaporated. There is no obvious misalignment of market interest rate expectations and the likely course of policy given information available today. What I believe will happen is that FOMC policy decisions and market expectations will evolve as newly arriving data either change, or affirm, the current outlook for the economy. The policy statement following the FOMC’s meeting of May 10 indicated the Committee’s view that economic growth was on a solid, but moderating, track and that inflation was contained, but still a risk.

The Committee also emphasized that future policy would depend on how arriving information affected the economic outlook. I myself place great emphasis on this point. Experience indicates that economic forecasts are not especially accurate, and that means that monetary policy actions should depend on how the outlook changes with new information rather than be decided in advance based on the forecast.

I hope I’ve provoked you sufficiently that you’ll ask some questions. Fire away.